PATENT
Docket No. 28221.5
Customer No. 000027683

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:
Yee Yvonne Chen

Serial No. (YET TO BE ASSIGNED)
(Based on
Serial No. 09/549,269
Filed: April 14, 2000)

Filed: Herewith

For: METHOD AND APPARATUS FOR EFFICIENT SURFACE GENERATION OF PURE O_3

Examiner: K. Mayekar

Group Art Unit: 1741

PRELIMINARY AMENDMENT

Box: Fee Amendment
Commissioner For Patents
Washington, DC 20231

Sir:

Prior to examining the above-identified continuation application, please amend the application as follows:

IN THE SPECIFICATION:

Insert after the Title of the Invention, the following paragraph:

-- This is a continuation of pending U.S. Patent Application Serial No. 09/549,269, filed April 14, 2000. - - .

IN THE CLAIMS:

Cancel claims 1-46.

Add new claims 47-105, as follows:

47. (New) An apparatus for generating ozone (O_3) comprising:

a source for providing at least a mixture of O and O_2 species; and

a quencher disposed proximate an output of said source for generation of ozone from the mixture of O and O_2 species, said quencher configured to generate ozone by adsorption on a surface of said quencher.

48. (New) The apparatus of claim 47, wherein said source includes one selected from a radio frequency (RF) plasma source and a microwave plasma source.

49. (New) The apparatus of claim 47, wherein the surface of said quencher includes an ozone generation surface located down-stream of said source, wherein the O and O_2 species of the mixture operate to flow across the ozone generation surface, and further wherein one of the O and O_2 species of the mixture adsorbs to the ozone generation surface while the other of the O and O_2 species of the mixture collides with the adsorbed species to generate ozone.

50. (New) The apparatus of claim 49, further wherein the ozone generation surface includes a plurality of ozone generation surfaces.

51. (New) The apparatus of claim 50, still further wherein the plurality of ozone generation surfaces include a plurality of flow channels having inputs and outputs, the inputs disposed proximate the output of said source.

52. (New) The apparatus of claim 47, further comprising:

means for controlling at least one of a temperature, a pressure, a flow rate, and a mixture ratio of O and O_2 in said quencher for producing a desired form of liquid-phase or gas-phase ozone.

53. (New) The apparatus of claim 52, wherein said control means includes a thermal channel coupled with said quencher and configured to pass a coolant through the thermal channel.

54. (New) The apparatus of claim 53, wherein said control means further includes means for controlling a flow rate of coolant through the thermal channel.

55. (New) The apparatus of claim 53, wherein the coolant includes one selected from liquid nitrogen, liquid helium, and liquid oxygen.

56. (New) The apparatus of claim 47, wherein the surface of said quencher includes an ozone generation surface having a combination of surface area and surface temperature in which O_2 from the mixture adsorbs on the ozone generation surface, the adsorbed O_2 creating at least one molecule layer of O_2 to form an O_2 and phonon supply surface, and further wherein O from the mixture collides with the adsorbed O_2 to form ozone.

57. (New) The apparatus of claim 56, further wherein the O_2 from the mixture adsorbs on the ozone generation surface by at least one of physisorption and chemisorption.

58. (New) The apparatus of claim 47, wherein the surface of said quencher includes an ozone generation surface having a combination of surface area and surface temperature in which O from the mixture adsorbs on the surface, the adsorbed O creating at least one molecule layer of O to form an O and phonon supply surface, and further wherein O_2 from the mixture collides with the adsorbed O to form ozone.

59. (New) The apparatus of claim 58, further wherein the O from the mixture adsorbs on the ozone generation surface by at least one of physisorption and chemisorption.

60. (New) An apparatus for generating ozone (O_3) comprising:

a source for producing at least a mixture of O and O_2 species;

a quencher disposed proximate an output of said source for generation of ozone from the mixture of O and O_2 species, said quencher configured to generate ozone by adsorption on a surface of said quencher, wherein the surface of said quencher includes a plurality of ozone generation surfaces located down-stream of said source, the plurality of ozone generation surfaces including flow channels having inputs and outputs, the inputs disposed proximate the output of said source, wherein the O and O_2 species of the mixture operate to flow across the ozone generation surfaces, and wherein one of the O and O_2 species of the mixture adsorbs to the ozone generation surfaces while the other of the O and O_2 species of the mixture collides with the adsorbed species to generate ozone; and

means for controlling at least one of a temperature, a pressure, a flow rate, and a mixture ratio of O and O_2 in said quencher for producing a desired form of liquid-phase or gas-phase ozone, said control means including at least one channel in thermal communication with said quencher configured to pass a coolant through the at least one channel and a flow valve for controlling a flow rate of coolant through the at least one channel.

61. (New) A method for generating ozone (O_3) comprising:

providing a source of at least a mixture of O and O_2 species; and

disposing a quencher proximate an output of the source for generation of ozone from the mixture of O and O_2 species, the quencher configured to generate ozone by adsorption on a surface of the quencher.

62. (New) The method of claim 61, wherein providing the source includes providing one selected from a radio frequency (RF) plasma source and a microwave plasma source.

63. (New) The method of claim 61, wherein the surface of the quencher includes an ozone generation surface, and wherein disposing the quencher proximate an output of the source includes locating the ozone generation surface down-stream of the source, wherein the O and O_2 species of the mixture flow across the ozone generation surface, further wherein one of the O and O_2 species of the mixture adsorbs to the ozone generation surface while the other of the O and O_2 species of the mixture collides with the adsorbed species to generate ozone.

64. (New) The method of claim 63, wherein the ozone generation surface includes a plurality of ozone generation surfaces.

65. (New) The method of claim 64, further wherein the plurality of ozone generation surfaces include a plurality of flow channels having inputs and outputs, the inputs disposed proximate the output of the source.

66. (New) The method of claim 61, further comprising:

controlling at least one of a temperature, a pressure, a flow rate, and a mixture ratio of O and O_2 in the quencher for producing a desired form of liquid-phase or gas-phase ozone.

67. (New) The method of claim 66, wherein controlling the temperature of the quencher includes providing a thermal channel coupled with the quencher and configured to pass a coolant through the thermal channel.

68. (New) The method of claim 67, wherein controlling the temperature further includes controlling a flow rate of coolant through the thermal channel.

69. (New) The method of claim 67, wherein the coolant includes one selected from liquid nitrogen, liquid helium, and liquid oxygen.

70. (New) The method of claim 61, wherein the surface of the quencher includes an ozone generation surface having a combination of surface area and surface temperature in which O_2 from the mixture adsorbs on the ozone generation surface, the adsorbed O_2 creating at least one molecule layer of O_2 to form an O_2 and phonon supply surface, and further wherein O from the mixture collides with the adsorbed O_2 to generate ozone.

71. (New) The method of claim 70, further wherein the O_2 from the mixture adsorbs on the ozone generation surface by at least one of physisorption and chemisorption.

72. (New) The method of claim 61, wherein the surface of the quencher includes an ozone generation surface having a combination of surface area and surface temperature in which O from the mixture adsorbs on the surface, the adsorbed O creating at least one molecule layer of O to form an O and phonon supply surface, and further wherein O_2 from the mixture collides with the adsorbed O to generate ozone.

73. (New) The method of claim 72, further wherein the O from the mixture adsorbs on the ozone generation surface by at least one of physisorption and chemisorption.

74. (New) A method for generating ozone (O_3) comprising:

providing a source of at least a mixture of O and O_2 species;

disposing a quencher proximate an output of the source for generation of ozone from the mixture of O and O_2 species, the quencher configured to generate ozone by adsorption on a surface of the quencher, wherein the surface of the quencher includes a plurality of ozone generation surfaces located down-stream of the source output, the plurality of ozone generation surfaces including flow channels having inputs and outputs, the inputs disposed proximate the source output, wherein the O and O_2 species of the mixture flow across the ozone generation surfaces, and wherein one of the O and O_2 species of the mixture adsorbs to the ozone generation surfaces while the other of the O and O_2 species of the mixture collides with the adsorbed species to generate ozone; and

controlling at least one of a temperature, a pressure, a flow rate, and a mixture ratio of O and O_2 in the quencher for producing a desired form of liquid-phase or gas-phase ozone, wherein controlling the temperature includes providing at least one channel in thermal communication with the quencher configured to pass a coolant through the at least one channel and controlling a flow rate of coolant through the at least one channel.

75. (New) A method of generating ozone (O_3) comprising:

producing a mixture of O and O_2 species; and

directing the mixture of O and O_2 for movement over an ozone generation surface of a quencher, wherein the O and O_2 species of the mixture flow across the ozone generation surface of the quencher, and wherein the quencher is configured to generate ozone from the mixture of O and O_2 species by adsorption on the ozone generation surface.

76. (New) The method of claim 75, further comprising:

controlling at least one of a temperature of the ozone generation surface, a pressure, a flow rate, and a mixture ratio of O and O_2 through the quencher for producing a desired form of liquid-phase or gas-phase ozone.

77. (New) The method of claim 75, wherein the ozone generation surface includes a plurality of flow channels disposed within the quencher, the flow channels having inputs and outputs, the inputs arranged proximate an output of the source of O and O_2 mixture.

78. (New) The method of claim 77, further comprising regulating a temperature of the ozone generation surface.

79. (New) The method of claim 78, wherein regulating the temperature includes controlling the flow rate of a coolant flowing through a cooling channel thermally coupled with the quencher.

80. (New) The method of claim 79, wherein the coolant includes one selected from liquid nitrogen, liquid helium, and liquid oxygen.

81. (New) An apparatus for generating a polyatomic form of an element comprising:

a source for producing at least a mixture of single atomic and double atomic species of the element; and

a quencher disposed proximate an output of said source for generation of the polyatomic form of the element from the mixture of single atomic and double atomic species of the element, said quencher configured to generate the polyatomic form of the element by adsorption on a surface of said quencher.

82. (New) The apparatus of claim 81, wherein said source includes one selected from a radio frequency (RF) plasma source and a microwave plasma source.

83. (New) The apparatus of claim 81, wherein the surface of said quencher includes a generation surface located down-stream of said source, wherein the single atomic and double atomic species operate to flow across the generation surface, wherein one of the single atomic and double atomic species adsorbs to the generation surface while the other of the single atomic and double atomic species of the mixture collides with the adsorbed species to generate the polyatomic form of the element.

84. (New) The apparatus of claim 83, further wherein the generation surface includes a plurality of generation surfaces.

85. (New) The apparatus of claim 84, still further wherein the plurality of generation surfaces include a plurality of flow channels having inputs and outputs, the inputs disposed proximate the output of said source.

86. (New) The apparatus of claim 81, further comprising:

means for controlling at least one of a temperature, a pressure, a flow rate, and a mixture ratio of O and O_2 in said quencher for producing a desired liquid-phase or gas-phase polyatomic form of the element.

87. (New) The apparatus of claim 86, wherein said control means includes at least one thermal channel coupled with said quencher and configured to pass a coolant through the thermal channel.

88. (New) The apparatus of claim 87, wherein said control means controls a flow

rate of coolant through the at least one thermal channel.

89. (New) The apparatus of claim 87, wherein the coolant includes one selected from liquid nitrogen, liquid helium, and liquid oxygen.

90. (New) The apparatus of claim 81, wherein the element includes oxygen and the polyatomic form of the element includes ozone (O_3).

91. (New) A system for processing media with ozone (O_3) comprising:

at least one processing vessel configured for receiving media to be processed; and

means for supplying ozone to said at least one processing vessel to facilitate a processing of the media by the ozone, said ozone supplying means including a source for producing at least a mixture of O and O_2 species, and a quencher disposed proximate an output of the source for generation of ozone from the mixture of O and O_2 species, the quencher configured to generate ozone by adsorption on a surface of the quencher.

92. (New) The system of claim 91, further comprising:

means for destroying residual ozone subsequent to a processing of the media.

93. (New) The system of claim 91, wherein said at least one processing vessel includes a processing chamber, the processing chamber having an input and an output, said system further comprising:

means for disposing media into the processing chamber via the input of the processing chamber, and

means for removing the processed media from the processing chamber via the output of the processing chamber.

94. (New) The system of claim 91, wherein said at least one processing vessel includes a semiconductor substrate processing chamber, and wherein the media includes at least one semiconductor substrate.

95. (New) The system of claim 91, wherein said at least one processing vessel includes a bioremediation processing chamber, and wherein the media includes at least one selected from gaseous media, liquid media, and solid media.

96. (New) A method for processing media with ozone (O_3) comprising:

disposing media to be processed into at least one processing vessel; and

supplying ozone to the at least one processing vessel to facilitate a processing of the media with ozone, wherein supplying ozone includes providing an ozone generator having a source for producing at least a mixture of O and O_2 species, and a quencher disposed proximate an output of the source for generation of ozone from the mixture of O and O_2 species, the quencher configured to generate ozone by adsorption on a surface of the quencher.

97. (New) The method of claim 96, further comprising:

destroying residual ozone subsequent to ozone processing of the media.

98. (New) The method of claim 96, wherein the at least one processing vessel includes a processing chamber, the processing chamber having an input and an output, said method further comprising:

disposing the media into the processing chamber via the input of the processing chamber; and

removing the processed media from the processing chamber via the output of the processing chamber.

99. (New) The method of claim 96, wherein the at least one processing vessel includes a semiconductor substrate processing chamber, and wherein the media includes at least one semiconductor substrate.

100. (New) The method of claim 96, wherein the at least one processing vessel includes a bioremediation processing chamber, and wherein the media includes at least one selected from a gaseous media, a liquid media, and a porous solid media.

101. (New) A quencher for generating ozone (O_3) comprising:

at least one housing;

at least one flow channel disposed in said at least one housing, the at least one flow channel including an input and an output; and

at least one adsorption surface disposed within said at least one flow channel, wherein responsive to inputting a mixture of O and O_2 species to the at least one flow channel input, the O and O_2 species of the mixture operate to flow across said at least one adsorption surface, further wherein one of the O and O_2 species of the mixture adsorbs to said at least one adsorption surface while the other of the O and O_2 species of the mixture collides with the adsorbed species to generate ozone for outputting at the at least one flow channel output.

102. (New) The quencher of claim 101, wherein said at least one adsorption surface includes a plurality of adsorption surfaces.

103. (New) The quencher of claim 101, further comprising:

means for controlling a temperature of said adsorption surface for producing a desired form of liquid-phase or gas-phase ozone.

104. (New) The quencher of claim 103, wherein said temperature control means includes a thermal channel coupled with said housing and configured to pass a coolant through the thermal channel.

105. (New) The quencher of claim 104, wherein said temperature control means further includes means for controlling a flow rate of coolant through the thermal channel.

REMARKS

By this preliminary amendment, claims 1-46 have been cancelled and new claims 47-105 have been added. Claims 47-105 remain in the application. This preliminary amendment is being filed concurrently with a continuation application as identified above. Examination of the continuation application, as amended, is respectfully requested.

New claims 47-105 have been added to provide for added claim coverage of the embodiments disclosed in the parent application. The claims are supported by the specification and drawings as originally filed (See for example, Figs. 1-4 and corresponding text, page 9, lines 1-14, and page 12, lines 4-11). The amendments herein are fully supported by the original specification and drawings, therefore, no new matter is introduced.

It is respectfully submitted that claims 47-105 are in condition for allowance. Accordingly, an early Notice of Allowance is courteously solicited.

Respectfully submitted,

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Dated: Dec. 28, 2001

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DATE OF DEPOSIT: 12-28-01

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